



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the application of: Poulsen et al.
Serial No.: 09/998,284
Filed: November 30, 2001
For: *Composition*

Examiner: Nashaat T. Nashed
Group Art Unit: 1656

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BRIEF ON APPEAL UNDER 37 C.F.R § 1.192

Appellants are appealing the rejection of claims 1-3, 9-15, 34, 35 and 40-50 dated November 20, 2007. A Notice of Appeal is being filed concurrently. Appellants request that the rejection of these claims be reversed.

(i) Real Party in Interest

The real party of interest is Danisco A/S, the assignee of the above-captioned application.

(ii) Related Appeals and Interferences

There are no related appeals or interferences.

(iii) Status of Claims

Claims 1-3, 9-15, 34, 35 and 40-50 are pending and are being appealed. Claims 1, 49 and 50 are in independent form.

(iv) Status of Amendments

No amendments were made to the claims subsequent to the rejection mailed December 13, 2006.

(v) Summary of Claimed Subject Matter

Claim 1 relates to an anti-fouling composition that includes a surface coating material, a first enzyme, a first substrate and a second enzyme. See Abstract, page 6, lines 18-22 and page 17, lines 3-4 of the specification. The first substrate is an oligomer or a polymer of a second substrate. See page 16, lines 11-13 of the specification. The second substrate is a substrate for an oxidative enzyme, and the first enzyme is capable of generating the second substrate from the first substrate. See page 15, lines 12-16, page 16, lines 1-17 of the specification. The second enzyme is an oxidase. See page 7, line 3 and page 15, line 30 of the specification. The second enzyme generates an anti-fouling compound when acting on the second substrate. See page 15, lines 12-16 of the specification.

Claim 49 relates to a method for releasing an anti-fouling compound from a surface coating that includes incorporating in a surface coating a first enzyme, a first substrate and a second enzyme. See Abstract, page 6, lines 18-22 and page 17, lines 3-14 of the specification. The first substrate is an oligomer or a polymer of a second substrate. See page 16, lines 11-13 of the specification. The second substrate is a substrate for an oxidase enzyme, and the first enzyme generates the second substrate from the first substrate. See page 15, lines 12-16, page 16, lines 1-17 of the specification. The second enzyme is an oxidase. See page 7, line 3 and page 15, line 30 of the specification. The second enzyme generates an anti-fouling compound by acting on the second substrate. See page 15, lines 12-16 of the specification.

Claim 50 relates to a method for treating a surface of a vessel that includes applying a coating material to the surface in which the coating material includes a first enzyme, a first substrate and a second enzyme. See Abstract, page 6, lines 18-22 and page 17, lines 3-14 of the specification. The first substrate is an oligomer or a polymer of a second substrate. See page 16, lines 11-13 of the specification. The second substrate is a substrate for an oxidase enzyme, and the first enzyme generates the second substrate from the first substrate. See page 15, lines 12-16, page 16, lines 1-17 of the specification. The second enzyme is an oxidase. See page 7, line 3 and page 15, line 30 of the specification. The second enzyme generates an anti-fouling compound by acting on the second substrate. See page 15, lines 12-16 of the specification.

(vi) Grounds of Rejection to be Reviewed on Appeal

1. Whether claims 1-3, 9-15, 34, 35 and 40-50 are unpatentable under 35 U.S.C. § 103 as being obvious over EP 0866103 to Hamade et al. in view of U.S. Patent No. 5,770,188 to Hamade et al., Hansen et al., *J. Biol. Chem.*, 272(17), p. 11581-7 (1997) and James et al., *J. Food Biochem.*, 21, p. 1-52 (1997).
2. Whether claims 1-3, 9-15, 34, 35 and 40-50 are unpatentable under 35 U.S.C. § 103 as being obvious over EP 0866103 to Hamade et al. in view of U.S. Patent No. 5,770,188 to Hamade et al., U.S. Patent No. 6,251,626 to Stougaard ("Stougaard") and James et al., *J. Food Biochem.*, 21, p. 1-52 (1997).

(vii) Arguments

1. Whether claims 1-3, 9-15, 34, 35 and 40-50 are unpatentable under 35 U.S.C. § 103 as being obvious over EP 0866103 to Hamade et al. in view of U.S. Patent No. 5,770,188 to Hamade et al., Hansen et al., *J. Biol. Chem.*, 272(17), p. 11581-7 (1997) and James et al., *J. Food Biochem.*, 21, p. 1-52 (1997).

Claims 1-3, 9-15, 34, 35 and 40-50 stand rejected under 35 U.S.C. § 103 as being unpatentable over EP 0866103 to Hamade et al. ("Hamade") in view of U.S. Patent No. 5,770,188 to Hamade et al. ("the '188 patent"), Hansen et al., *J. Biol. Chem.*, 272(17), p. 11581-7 (1997) ("Hansen") and James et al., *J. Food Biochem.*, 21, p. 1-52 (1997) ("James"). See Final Office Action mailed on November 20, 2007 ("Office Action") at p. 2.

Applicants have discovered a sustained release of an anti-fouling compound from an anti-fouling composition. See specification at p. 4, line 24 to p. 6, line 10. This is important, since the composition will prolong the protection of the ship hull against fouling organisms which is of huge economical interest. See specification at p. 1, line 34 to p. 2, line 12. The sustained release provided by the composition is achieved by providing a coating including two enzymes and a substrate for the first enzyme. See specification at p. 6, lines 18-22. Specifically, this first substrate is an oligomer of the second substrate and it is the conversion product of the second substrate that provides the anti-fouling compound. See specification at p. 15, lines 10-16, and p. 16, lines 11-13. The gist of applicant's discovery is thus that the substrate whose conversion leads to the formation of an anti-fouling coating is continuously generated over a long term

period, since it is formed upon conversion of an oligomeric/polymeric compound by the first enzyme. See specification at p. 16, lines 15-17, 27-29.

Claim 1 relates to an anti-fouling composition that includes a surface coating material, a first enzyme, a first substrate and a second enzyme. The first substrate is an oligomer or a polymer of a second substrate. The second substrate is a substrate for an oxidative enzyme, and the first enzyme is capable of generating the second substrate from the first substrate. The second enzyme is an oxidase. The second enzyme generates an anti-fouling compound when acting on the second substrate. Claim 49 relates to a method for releasing an anti-fouling compound from a surface coating that includes incorporating in a surface coating a first enzyme, a first substrate and a second enzyme. Claim 50 relates to a method for treating a surface of a vessel that includes applying a coating material to the surface in which the coating material includes a first enzyme, a first substrate and a second enzyme.

The Examiner has maintained that “[t]he cited prior art contain[s] specific suggestion of the claimed invention (Hamade *et al.*) and the inclusion of glucoamylase in antifouling composition.” *Id.* The Examiner further maintained that “Hamade *et al.* indicated that the substrate in the antifouling composition could be either one that is added to the composition directly or that was generated by one or more enzymes in the composition.” *Id.* The Examiner further contends that “the ‘188 patent which teaches a stable and durable antifouling composition comprising amyloglucosidase and starch was added to provide the nexus between amyloglucosidase and antifouling composition and expectation of success from the same art of antifouling composition.” See Office Action at p. 2-3.

In determining obviousness, the Supreme Court has stated that “a court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions.”¹ The Supreme Court has further stated that “[o]ften, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue.”²

¹ *KSR Int’l Co. v. Teleflex Inc.*, 127 S.Ct. 1727, 1740 (2007).

² *Id.* at 1740-1.

Further, “[t]o facilitate review, this analysis should be made explicit.”³ The Examiner has clearly failed to do so in the rejections of the present claims.

Claims 1, 49 and 50 each recite a coating including first substrate selected from oligomers and polymers of substrates for oxidative enzymes. Claims 1, 49 and 50 each recite a coating including a first enzyme. The first enzyme of the coating reacts with the oligomer or polymeric first substrate to produce a second substrate on which a second enzyme included in the coating material (an oxidase enzyme) is active. As Applicants have explained in the previous responses filed October 17, 2006 and September 24, 2007 and in the Pre-Appeal Brief Request for Review filed April 5, 2007, Hamade does not provide any teaching, suggestion or motivation to include a second enzyme in an anti-fouling composition or in a surface coating or coating material.

Hamade discloses a coating composition including **one single enzyme and one single substrate**, both of which can be selected from a list of possible enzymes and substrates, respectively. See page 3, line 46 to page 5, line 53 of Hamade. Hamade does not teach or suggest any other enzyme or substrate in a coating composition. Hamade also does not provide a reasonable expectation of successfully including a second enzyme in a composition or in a surface coating or coating material. Further, the disclosure in Hamade would actually lead the skilled person away from the subject matter at claims 1, 49 and 50 because Hamade teaches that a composition with only one enzyme has an anti-fouling effect. See Example 4 of Hamade.

Hamade describes “a coating composition comprising a film-forming resin, an enzyme, and a substrate” See Abstract of Hamade. Hamade describes that the

the compound having antimicrobial activity is produced by enzymatic reaction *between* an enzyme and a substrate. It should be understood that said compound having antimicrobial activity may be a compound obtained as the *direct result of enzymatic reaction between the enzyme and the substrate* or a compound formed from the product of *such enzymatic reaction through further enzymatic or chemical reaction*. The former case in which the compound having antimicrobial activity is the direct product of enzymatic reaction typically includes the case in which said substrate is a precursor of the compound having antimicrobial activity. Typical of the latter case in which the compound having antimicrobial activity is formed from such an enzymatic reaction product through further enzymatic or chemical reaction is the case in which such an enzymatic reaction product is a precursor of the objective compound having antimicrobial activity.

See p. 3, lines 38-46 of Hamade (emphasis added).

³ *Id.* at 1741.

Further, while Hamade describes the problem of achieving controlled release of the compound having antimicrobial activity, Hamade suggests that this problem is solved merely by dispersing the enzyme and the substrate in a matrix. See page 6, lines 3-12 of Hamade. In particular, Hamade states “[i]n the present invention, the penetration of water into the matrix occurs gradually and sustainedly so that the compound having antimicrobial activity is produced persistently at a controlled rate, thus achieving controlled release of this compound.” See page 6, lines 10-12 of Hamade. Hamade goes on to state that the problem of controlled release can be easily solved through the use of a coating composition that “comprises a film-forming resin, an enzyme, and a substrate, said enzyme being capable of reacting with said substrate to produce a compound having antimicrobial activity.” See page 6, lines 25-30 of Hamade. Thus, Hamade’s disclosure teaches away from the Applicant’s discovery as it suggests that a composition comprising an enzyme, a substrate and a film-forming resin is sufficient to overcome the problem of controlled release of the antimicrobial agent.

In contrast, the Applicant’s discovery requires the presence of a first substrate selected from oligomers and polymers of substrates for oxidative enzymes and further requires that the first enzyme reacts with an oligomer or polymeric first substrate to produce a further second substrate on which a second enzyme (an oxidase enzyme) is active.

Additionally, while Hamade provides a large list of non-limiting enzyme-substrate combinations which can generate a large number of different microbial agents (page 3, line 46 to page 5, line 53 of Hamade), no directions are given in Hamade that would lead a skilled person to select any specific type of enzyme combination over any of the others that are mentioned. In particular there is no suggestion or motivation to use an oxidase enzyme with a substrate that is generated by the action of a first enzyme on a first substrate.

MPEP 2145, paragraph X. A, states that “[a]ny judgment on obviousness is in a sense necessarily a reconstruction based on hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill in that art at the time the claimed invention was made and **does not include knowledge gleaned only from applicant’s disclosure**, such a reconstruction is proper” (emphasis added by Applicants) (citing *In re McLaughlin* 443 F.2d 1392, 1395 (CCPA 1971)). The Examiner’s obviousness rejection of the claims violates the basic considerations of obviousness as set forth in MPEP 2141 (“[t]he

references must be viewed without the benefit of impermissible hindsight vision afforded by the claimed invention.”).

There is no suggestion or motivation in Hamade to modify the teachings of Hamade to produce an anti-fouling composition that includes a surface coating material, a first enzyme, a first substrate and a second enzyme. Therefore, contrary to the Examiner's assertions, Hamade does not teach an anti-fouling composition that includes a surface coating material, a first enzyme, a first substrate and a second enzyme. Hamade also does not teach or suggest a method for releasing an anti-fouling compound from a surface coating that includes incorporating in a surface coating a first enzyme, a first substrate and a second enzyme. Hamade further does not teach or suggest a method for treating a surface of a vessel that includes applying a coating material to the surface wherein the coating material includes a first enzyme, a first substrate and a second enzyme.

Such a defect is not taught or suggested by the '188 patent. The '188 patent is directed to an antifouling paint composition which includes a lipid-coated enzyme. See col. 1, lines 8-12. In a preferred aspect described in the '188 patent, the paint comprises an enzyme-susceptible resin and the lipid-coated enzyme is an enzyme capable of catalyzing the degradation of said resin. See the Summary of Invention in '188 patent. The combination as suggested by the Examiner neglects the direct teaching of the '188 patent which discloses paint compositions that contain **a single lipid-coated enzyme** only. See the reference to “a lipid-coated enzyme” in the claims and the Statement of Invention. Applicants further note that all of the examples in the '188 patent use a single enzyme. As such, the '188 patent does not provide any suggestion or motivation as to solving the problem of sustained release by incorporating **two enzymes and a first substrate** to the coating composition, wherein the substrate is an oligomer/polymer compound of the second substrate.

Hence, Applicants submit that the combination of Hamade with the teachings of the '188 patent would merely reinforce the conclusion that a composition comprising a single enzyme is sufficient. As such, there is no suggestion or motivation in Hamade and the '188 patent to modify the teachings of Hamade and/or the '188 patent to produce an anti-fouling composition that includes a surface coating material, a first enzyme, a first substrate and a second enzyme. Each of Hamade and the '188 patent, and their combination, also does not teach or suggest a

method for releasing an anti-fouling compound from a surface coating that includes incorporating in a surface coating a first enzyme, a first substrate and a second enzyme. Hamade and the '188 patent further do not teach or suggest a method for treating a surface of a vessel that includes applying a coating material to the surface wherein the coating material includes a first enzyme, a first substrate and a second enzyme.

These defects are not remedied by the Hansen and James references either. Hansen describes the "purification and molecular cloning of hexose oxidase from *C. crispus*, and ... the cDNA sequence of the enzyme." See p. 11581 of Hansen. James describes glucoamylases, "methods used to assay glucoamylase activity," "structural analysis of glucoamylase and main amino acids involved in catalysis and starch binding" and "the use of glucoamylase in the industry." See Abstract of James. Further, Applicants submit that a person of skill in the art would not look to the James references as James relates to the food industry.

Accordingly, both Hansen and James do not teach or suggest an anti-fouling composition that includes a surface coating material, a first enzyme, a first substrate and a second enzyme. Hansen and James also do not teach or suggest a method for releasing an anti-fouling compound from a surface coating that includes incorporating in a surface coating a first enzyme, a first substrate and a second enzyme. Hansen and James further do not teach or suggest a method for treating a surface of a vessel that includes applying a coating material to the surface wherein the coating material includes a first enzyme, a first substrate and a second enzyme.

As such, claims 1, 49 and 50, and claims that depend from claim 1, are patentable over the combination of Hamade, the '188 patent, Hansen and James for at least the reasons described above. Applicants respectfully request reconsideration and withdrawal of this rejection.

2. Whether claims 1-3, 9-15, 34, 35 and 40-50 are unpatentable under 35 U.S.C. § 103 as being obvious over EP 0866103 to Hamade et al. in view of U.S. Patent No. 5,770,188 to Hamade et al., U.S. Patent No. 6,251,626 to Stougaard and James et al.; *J. Food Biochem.*, 21, p. 1-52 (1997).

Claims 1-3, 9-15, 34, 35 and 40-50 stand rejected under 35 U.S.C. § 103 as being unpatentable over Hamade in view of the '188 patent, U.S. Patent No. 6,251,626 to Stougaard ("Stougaard") and James. See Office Action at p. 2.

As previously described, Hamade, the '188 patent and James do not teach or suggest an anti-fouling composition that includes a surface coating material, a first enzyme, a first substrate and a second enzyme. Hamade and the '188 patent also do not teach or suggest a method for releasing an anti-fouling compound from a surface coating that includes incorporating in a surface coating a first enzyme, a first substrate and a second enzyme. Hamade and the '188 patent further do not teach or suggest a method for treating a surface of a vessel that includes applying a coating material to the surface wherein the coating material includes a first enzyme, a first substrate and a second enzyme.

This defect is not remedied in Stougaard. Stougaard describes "[a] method of producing hexose oxidase by recombinant DNA technology, recombinant hexose oxidase and the use of such enzyme, in particular in the manufacturing of food products such as doughs and dairy products, animal feed, pharmaceuticals, cosmetics, dental care products and in the manufacturing of lactones." See Abstract. Stougaard does not teach or suggest an anti-fouling composition that includes a second enzyme. Stougaard also does not teach or suggest a method for releasing an anti-fouling compound from a surface coating that includes incorporating in a surface coating a first enzyme, a first substrate and a second enzyme. Stougaard does not teach or suggest a method for treating a surface of a vessel that includes applying a coating material to the surface wherein the coating material includes a first enzyme, a first substrate and a second enzyme.

Accordingly, claims 1, 49 and 50, and claims that depend from claim 1, are patentable over the combination of Hamade, the '188 patent, Stougaard and James for at least the reasons described above. Applicants respectfully request reconsideration and withdrawal of this rejection.

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CONCLUSION

The rejection of all claims should be reversed for the reasons given above. The Commissioner is authorized to charge \$510 to the Deposit Account 19-4293 for the appeal brief fee. Should any further fees be required, please charge Deposit Account **19-4293**.

Respectfully submitted,

Date: 2/19/08

Peilin Tan-Aguino REG NO 59,280 for

Customer No. 27890
Steptoe & Johnson LLP
1330 Connecticut Avenue, NW
Washington, DC 20036-1795
Phone: 202-429-3000
Fax: 202-429-3902

Harold H. Fox
Reg. No. 41,498

(viii) Claims Appendix

1. An anti-fouling composition comprising
 - (i) a surface coating material;
 - (ii) a first enzyme and a first substrate, wherein the first substrate is an oligomer or a polymer of a second substrate, said second substrate being a substrate for an oxidative enzyme, and wherein first enzyme is capable of generating said second substrate from said first substrate; and
 - (iii) a second enzyme, wherein the second enzyme is an oxidase; and wherein said second enzyme generates an anti-fouling compound when acting on said second substrate.
2. A composition according to claim 1 wherein the oxidase is from a marine algae.
3. A composition according to claim 1 wherein the oxidase is from *Chondrus crispus*.
- Claims 4-8. (Cancelled)
9. A composition according to claim 1 wherein the first enzyme is amyloglucosidase.
10. A composition according to claim 1 wherein the first substrate is starch.
11. A composition according to claim 1 wherein the composition further comprises a binder to immobilise at least one of the constituents of the composition.

12. A coating consisting of a composition according to claim 1.

13. A coating according to claim 12 formulated for treatment of a surface selected from outdoor wood work, external surface of a central heating system, and a hull of a marine vessel.

14. A marine anti-foulant consisting of a composition according to claim 1.

15. A marine anti-foulant according to claim 14 wherein the anti-foulant is self-polishable.

Claims 16-33. (Cancelled)

34. The composition of claim 1, wherein the second substrate is a sugar.

35. The composition of claim 34, wherein the sugar is glucose.

Claims 36-39. (Cancelled)

40. The composition of claim 1, wherein the oxidase is a hexose oxidase.

41. The composition of claim 1, wherein the composition is formulated as a coating, lacquer, stain or enamel.

42. The composition of claim 1, wherein the composition further comprises a surface coating material selected from polyvinyl chloride resins in a solvent based system, chlorinated rubbers in a solvent based system, acrylic resins and methacrylate resins in solvent based or aqueous systems, vinyl chloride-vinyl acetate copolymer systems as aqueous dispersions or solvent based systems, butadiene copolymers such as butadiene-styrene rubbers, butadiene-acrylonitrile rubbers, and butadiene-styrene-acrylonitrile rubbers, drying oils such as linseed oil, alkyd resins, asphalt, epoxy resins, urethane resins, polyester resins, phenolic resins, derivatives and mixtures thereof.

43. The composition of claim 40, wherein the hexose oxidase comprises the amino acid sequence set out in SEQ ID NO: 2.

44. The composition of claim 40, wherein the hexose oxidase is obtained by cloning and expression in recombinant host organisms of a gene encoding the protein.

45. The composition of claim 1, wherein the first substrate is water insoluble.

46. The composition of claim 1, wherein the first substrate is selected from the group consisting of starch, lactose, cellulose, dextrose, peptide, inulin and mixtures thereof.

47. The composition of claim 1, wherein the oxidase is from a marine organism.

48. The composition of claim 1, wherein the first enzyme and the second enzyme are incorporated in the surface coating material.

49. A method for releasing an anti-fouling compound from a surface coating comprising incorporating in a surface coating:

(i) a first enzyme and a first substrate, wherein said first substrate is an oligomer or a polymer of a second substrate, said second substrate being a substrate for an oxidase enzyme, and wherein said first enzyme generates said second substrate from said first substrate;

(ii) a second enzyme, wherein said second enzyme is an oxidase and wherein the second enzyme generates an anti-fouling compound by acting on said second substrate.

50. A method for treating a surface of a vessel comprising applying a coating material to the surface, the coating material comprising:

(i) a first enzyme and a first substrate, wherein said first substrate is an oligomer or a polymer of a second substrate, said second substrate being a substrate for an oxidase enzyme, and wherein said first enzyme generates said second substrate from said first substrate; and

(ii) a second enzyme, wherein said second enzyme is an oxidase and wherein the second enzyme generates an anti-fouling compound by acting on said second substrate.

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(ix) Evidence Appendix

None.

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(x) Related proceedings Appendix

None.